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winters were more severe than now, the summers shorter, and the reindeer still abundant. At this time, the river, now occupying a comparatively small and shallow channel, flowed at an elevation of nearly fifty feet above its present level; and it was when such a mighty stream as this, that man first gazed upon its waters and lost those rude weapons in its swift current that now, in the beds of gravel which its floods have deposited, are alike the puzzle and delight of the archæologist. Had these first comers, like the troglodytes of France, had convenient caves to shelter them, doubtless we would have their better wrought implements of bone to tell more surely the story of their ancient sojourn here; but, wanting them, their history is not altogether lost, and in the rude weapons, now deep down beneath the grassy sod and flower-decked river bank, we learn at least the fact of the presence, in the distant past, of an earlier people than the Indian, and have a veritable trace of the American autochthon.

JOHNNY DARTERS.

BY D. S. JORDAN AND H. E. COPELAND.

ANY one who has ever been a boy, and can remember the days of green meadows, tag alders, and an angleworm on a pin hook, surely has not forgotten the little dusky fish which lay perfectly motionless on the pebbly bottom of the shallow stream, untempted by fly or worm, while over his head the silly little minnows strained their toothless mouths in a vain endeavor to swallow the bait meant for the nobler sun-fish. You will remember, too, that when, after watching him a while, you put down your hand to catch the little philosopher, just as you had covered him and were sure you had him he was resting as composedly as ever a few feet farther up the stream. That little fish was a Johnny Darter.

It is an ancient and venerable family, that to which he belongs, the family of Darters. It is exclusively American, but none the less ancient and venerable on that account, for its members in every pond and brook of our Eastern United States trace back their lineage through a dozen lines of descent to a primitive darter, which lived and loved a million of years before the time of David Bruce or William the Conqueror.

The naturalists know them as *Etheostomoids*, from *Etheostoma*, the name given by Rafinesque to the first ones described, for until 1820, no writer on such matters supposed the Johnnies to be fully developed fishes, but thought them the young of some perch or bass. Even for twenty-five years later, the wise men of the East who study nature in books and bottles, and do not know her when they meet her out-of-doors, spoke of Etheostoma as a mere "myth," having "no existence save in the fertile brain of men of versatile but disordered intellect," as they were pleased to style Rafinesque and others who saw things not described by Cuvier or dreamed of by Valenciennes.

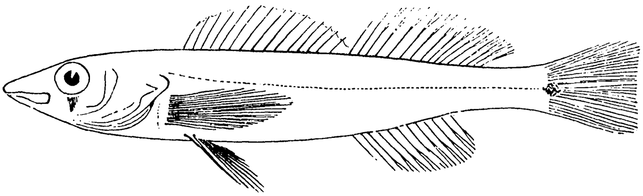
The books call these fishes "Darters," from *Boleosoma* (*dart body*, in Greek), the name of the common eastern species; the realistic dwellers of the Ohio Valley call some of them hog-fishes; the boys call them Johnnies, and, as the boy instinct is the truest, Johnny Darters they shall be.

All the darters are very small fishes; the largest barely reaches the minimum of size on the urchin's string when he comes back from the mill-pond, while the smallest is with one or two exceptions the least of all fishes. They have only the rudiment of an air bladder, and are therefore unable to float freely in the water or even to swim at all without severe manual — not caudal — labor. They rest quietly on the bottom for the most part, curled up under a stone or standing on their front and tail fins; now and then throwing themselves forward for a short distance by a broad and sudden sweep of the pectorals, to snap at some water-bug or to dodge the claws of some crawfish or the grasp of some small boy. This movement made, they come to rest, either permanently or until they can bring their arms forward again. When a darter wishes to swim for any distance his course is peculiar: at every impulse forward he rises in the water; at every rest he begins to fall, his face meanwhile wearing an expression of contented helplessness. The whole movement is much like that of a boy learning to swim, whose nose goes under when he brings his arms forward after each stroke.

The mouth of the darter bristles with teeth, which indicate its carnivorous habits, and its great voracity makes it in a small way the terror of the aquarium, for it carries death and dismay to timid water-snails and the smaller crustaceans. It pounces upon a piece of meat with all the ferocity of a wild-cat, having none of the timid eagerness characterizing the minnows, and little of the graceful dash of the perch and bass.

Rafinesque says of the Johnnies of his acquaintance, "They are good to eat, fried." This is doubtless true, but I should as soon think of filling my pan with wood-warblers. The good man goes a-fishing not for "pot-luck," but to let escape "the Indian within him."

Their small size, brilliant coloration, quaintness, and hardiness render the darters very desirable aquarium fishes, much more attractive in every respect than the cheap and vulgar gold-fish. They are little known even to naturalists; few of them have ever been figured, and the biography of none ever written, so we hope that this attempt to tell the story of some that we know may not be unattractive to those who can see something more in a little fish than a possible dinner to themselves or to a king-fisher.



(FIG. 22.) PERCINA.

The barred darter or log perch (*Percina caprodes;* Figure 22 represents a species of Percina) is the largest of the Etheostomoids. It may be most readily known by its superior size and by its peculiar pattern of coloration. The ground color is pale olive, darker above, silvery beneath; on this are about fifteen black vertical bars or incomplete rings, alternating more or less perfectly with as many shorter ones, which reach only half-way down or to the lateral line; the hindmost bar is reduced to a mere spot at the base of the caudal, and there are many black specks and mottlings on the fins. The body is long and slender, nearly cylindrical, and firm and wiry to the touch; the dorsal fins are large, and the first consists of about thirteen spines; the head is flat on top and tapers into a flat, pointed snout, which is abruptly squared off at the end, much overlapping the small mouth, after the fashion of the pig. The lateral line, as in all the species mentioned in this article, is perfectly distinct from the head to the tail.

Percina reaches a length of six or eight inches, and it may be readily caught with a hook baited with a worm. I often meet an urchin with one or two of them strung through the gills on a forked stick, along with "red eyes," "stone toters," and other "boys' fish." At such times, I generally buy the log perch for a cent, cut it open to look at the air bladder which the books say it does not have, and then lay it away with the rest of my treasures in the bottle of alcohol.

We find Percina usually in rapid and rather deep water, as deep as we dare wade in when seining in hip boots. We rarely find them small enough for ordinary aquarium purposes, and the living specimen before me, though wonderfully quick and graceful, has shown little that is noteworthy, save his courage, love of angleworms, and a possible disposition to bury himself in the sand. There is something in the expression of his face, as he rests on his "hands and feet" on a stone, remarkably lizard-like, reminding me of the blue-tailed skink (*Eumeces fasciatus*).

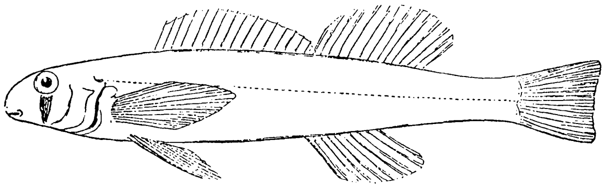
We next come to the fine gentleman of the family, the black-sided darter (*Etheostoma blennioides*). This species may be known best by its coloration. The ground hue is a salmon yellow; the back is regularly and beautifully marbled with black, forming a peculiar and handsome pattern. On the sides, from the head to the tail runs a jet-black band which is widened at irregular intervals into round spots, which contrast sharply with the silvery color of the belly. Or we might say that on each side is a chain of confluent, round, black blotches. At times these spots are quite pale and do not seem to meet, but in an instant they regain their original form and shade. These changes are when the fish is excited by the presence of things eatable. A male in our aquarium underwent almost in an instant an entire change of pattern upon the introduction of a female fish of the same species, whom he recognized as his true affinity. Although the two have been together for some weeks, the novelty has not yet worn off, and though his colors vary much from one hour to another, he has never quite reverted to his original dress.

The form of the black-sided darter is more graceful than that of any other, and his movements have less of the angular jerkiness which distinguishes his relatives.

The dorsal fins, as in Percina, are long and large, the number of spines being about fourteen. Etheostoma delights in clear running water, and he may be found in most streams south and west of New York. A notable peculiarity is the presence of a row of shields or enlarged scales along the middle line of the belly. These may serve to protect that part from the friction of the stony bottom. They seem to be shed at some seasons, but when and why is unknown.

Etheostoma is especially desirable for aquaria. He is hardier than any other fish as pretty, and prettier than any other as hardy, and withal he "has a way of his own," as Barney Mullins said of Thoreau.

The most simply beautiful of all fresh-water fishes is the green-sided darter (*Diplesium blennioides;* Figure 23 represents a species of this genus). He is not, like the Pœcilichthys, an animated rainbow, but has the beauty of green grass, wild violets, or a log covered with green moss. As we watch him in the water, with his bright, blended colors and gentle ways, once more, with Izaak Walton's Angler, "We sit on cowslip banks, hear the birds sing, and possess ourselves in as much quietness as the silent, silver streams which we see glide so quietly by us."



(FIG. 22.) DIPLESIUM.

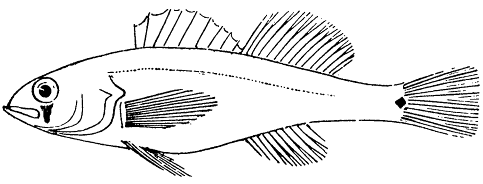
During the ordinary business of the year the Diplesium, like most sensible fishes and men, dresses plainly. It is a serious matter to get any time for contemplation when the streams are low and food scarce, and a plain coat may ward off danger as well as facilitate attack. At all times, however, he may be known by these marks: the fins are all large, and the first dorsal has thirteen spines ; the back is covered with zigzag markings down to the lateral line, which is complete and continuous, while below it extend eight or nine arrow-shaped, olive spots, which are more or less connected above, sometimes as if forming a wavy line; these are on a nearly white ground, which blends with the uniform coloration of the belly. The eyes are quite large and prominent, the snout is short and rounded, giving a decidedly frog-like profile, while on a front view the little, inferior mouth seems puckered with "prunes and prisms." The roof of the mouth is toothless, though all the other Johnnies have small teeth on the front part of the roof behind the jaws, the region technically known as the vomer.

But when the first bluebirds give warning by their shivering and bodiless notes that spring is coming, then the Diplesium puts on his wedding clothes and becomes in fact the green-sided darter. The dorsal fins become bright grass-green, with a scarlet band at the base ; the broad anal has a tinge of the deepest emerald, while every spot and line upon the side has turned from an undefined olive to a deep, rich green, scarcely found elsewhere in the animal world except on the backs of frogs.

The same tint flashes out on the branching rays of the caudal fin, and may be faintly seen struggling through the white on the belly. The blotches nearest the middle of the back become jet-black, and thickly sprinkled everywhere are little shiny spots of a clear, bronze orange. In the aquarium, Diplesium seems more shy and retiring, too much of a fine lady to scramble for angle-worms or to snap at the "bass-feed." She is usually hidden among the plants, or curled up under an arch of stones or in a geode. Specimens may be caught most abundantly in rapid, gravelly streams, but we often find stray individuals lying on sandy bottoms, the proper home of the Pleurolepis.

Boleosoma effulgens[1] is the darter of darters. Although our earliest aquarium friend, for the very first specimen placed there showed us by a rapid ascent of the river-weed how "a Johnny could climb trees," he has still many resources which we have never learned. Whenever we try to catch one with the hand we begin with all the uncertainty which characterized our first attempt, even if we have him in a two-quart pail.

He may be known from his cousins by his short first dorsal fin of nine spines, and by the absence of all color save soft brown on white that has the faintest tinge of yellow, but not a dirty white at all. The other nine-spined darters, Pœcilichthys, etc. (Figure 24 represents a species of this genus), have a different mouth, a projecting lower jaw,[2] the body deeper, and the lateral line vanishing on the back of the body. The brown on the sides of Boleosoma is arranged in seven or eight W-shaped marks, below which are a few flecks of the same color. Covering the sides above the lateral line are wavy markings, — gathered into blotches on the


(FIG. 24.) PŒCILICHTHYS.

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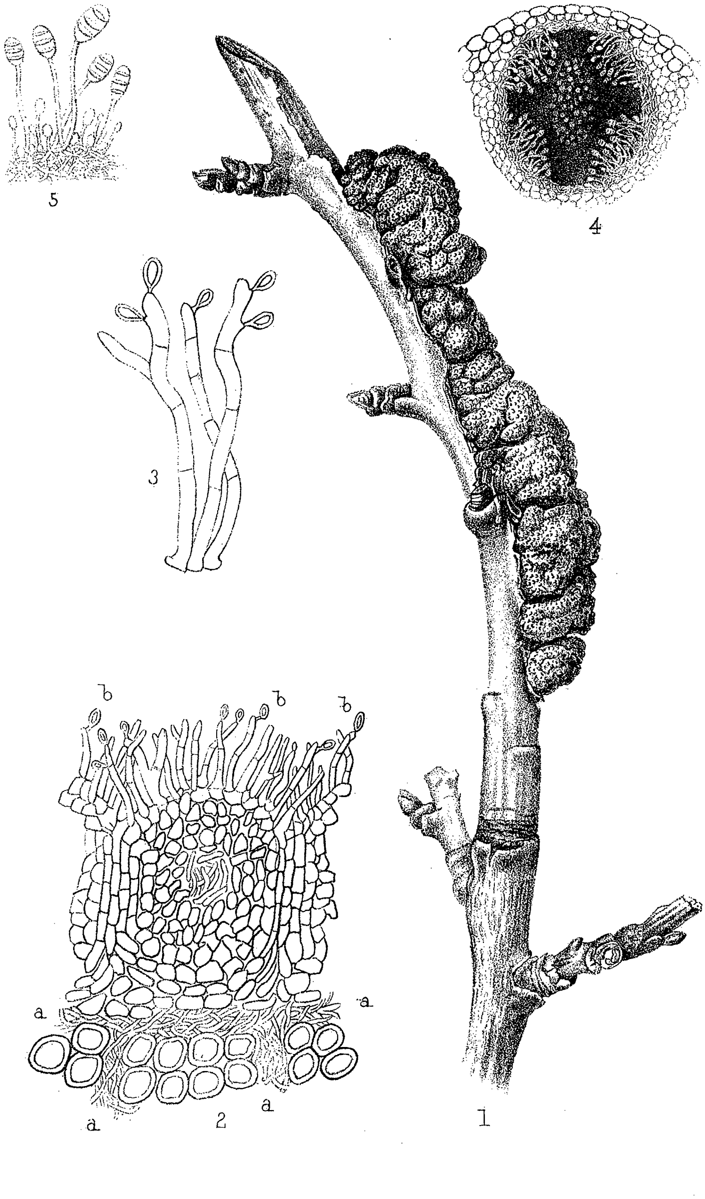
[1] *Boleosoma effulgens* is the common species in the neighborhood of Indianapolis, to which latitude all the accounts here given must be referred. Eastward occurs *Boleosoma olmstedi*, which is somewhat larger and has the cheeks thickly scaly. We are not quite sure that the change of color in Diplesium depends on the season, but our observations thus far indicate it.

[2] Not as represented in the figure, in which the body is also represented too deep. The cuts accompanying this article are outlines only and erroneous in many of the details. While of much value as giving a general idea of the Etheostomoids, nevertheless the authors disclaim any responsibility for them.

PLATE III



T. Sinclair & Son, lith. Phila.

median line, — that have given him the name of tesselated darter, said by the books to be "common." But Boleosoma is a braver name, and we even prefer "Boly," for short. The head resembles that of Diplesium, but the habit of leaning forward over a stone, resting on the front fins, gives a physiognomy even more frog-like; his actions however, are, rather bird-like, for he will strike attitudes like a tufted titmouse, and he flies rather than swims through the water. He will with much perseverance push his body between a plant and the side of the aquarium, and balance himself on the slender stem. Crouching cat-like before a snail-shell, he will snap off the horns which the unlucky owner pushes timidly out. But he is often less dainty, and, seizing the animal by the head, dashes the shell against the glass or a stone until he pulls the body out or breaks the shell. "Boly," alas! is the "Quaker of our aquarium" only in appearance.

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THE BLACK KNOT.

THE following article is an abstract, by Mr. B. D. Halsted, of a paper by Prof. W. G. Farlow published in the Bulletin of the Bussey Institution of March, 1876. It will be the endeavor to give, with the aid of two of the three original plates,[1] a brief notice of the most important points concerning this destructive fungus.

Without doubt, the most striking disease of vegetable origin occurring on fruit-trees in this country is that commonly known as the black knot. The disease takes its name from the unsightly, black, wart-like excrescences, with which every one is familiar, on plum-trees and different kinds of wild and cultivated cherries. It is found in all parts of our country east of the Rocky Mountains, and is so common and destructive that in some districts one seldom sees a plum-tree free from the knot. An idea may be formed of the small crop of plums now raised in New England from the fact that two dollars and a half were given in Boston last autumn for a peck of damsons for preserving. In some parts of New England, particularly in Maine and along the sea-coast, the raising of cherries has also been almost aban-

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[1] The sum of $500 was voted by the Trustees of the Massachusetts Society for Promoting Agriculture to aid Professor Farlow in his researches, and from this liberal appropriation the expense of the plates was defrayed. Professor Farlow is himself responsible for the microscopic details of the plates, but whatever of beauty they may possess is entirely due to the skill of Mr. J. H. Blake, of the Museum of Comparative Zoölogy, Cambridge.